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react with a substrate in the second chamber in a process
conversion step.

REMARKS

Claims 1-7 and 17-20 were examined. Claims 1, 4, 6, and 17 are amended. Claim 7-16 are canceled. Claims 1-6 and 17-20 remain in the application.

The Patent Office requests affirmation of a prior election. The Patent Office rejects claims 1-4, 6-7, and 17-20 under 35 U.S.C. §102(b). The Patent Office objects to claim 5. Reconsideration of the claims is respectfully requested in view of the above amendments and the following remarks.

A. Affirmation of Election

Applicants hereby affirm the election of Group I drawn to claims 1-7 and 17-20. In this regard, Applicants cancel claims 8-16.

B. 35 U.S.C. §102(b): Rejection of Claims 1-4 & 6-7

The Patent Office rejects claims 1-4 and 6-7 under 35 U.S.C. §102(b) over the article "Dry Etching of Polycrystalline Silicon," Matsuo, P.J., et al., J. Vac. Sci. Technol. A 15(4), Jul/Aug 1997 (Matsuo). Matsuo describes an etching process of polycrystalline silicon. Matsuo describes the study using etch species of CF₄/O₂

and N₂. Applicants' understanding of Matsuo is that the reference teaches combining nitrogen with O₂ and CF₄ in a remote plasma chamber. The nitrogen reacts with oxygen in a manner to enhance a plasma.

The effects of N₂ addition on the production of atomic oxygen is seen in Fig. 8. Clearly, injection of nitrogen into the discharge enhances the dissociation of molecular oxygen.

Figure 9 shows the NO concentration in the processing chamber as a function of the O₂/CF₄ ratio in the discharge. Upon inclusion of oxygen into the CF₄/N₂ discharge, we see significant NO production which then maintains its concentration through greater O₂/CF₄ ratios.

Independent claim 1, as amended, is not anticipated by Matsuo, because Matsuo does not describe an apparatus including a nitrogen gas source, an excitation energy source to generate a nitrogen plasma comprising ions and radicals from nitrogen gas and a first reaction chamber coupled to a second reaction chamber and separated from a substrate site in the second reaction chamber by a distance equivalent to a lifetime of ions at a plasma generation rate such that the radicals react with the substrate in a process conversion step. Matsuo describes etching, not process conversion. It is not clear that Matsuo even forms a nitrogen plasma. It is more apparent that the nitrogen reacts with oxygen in the remote chamber in the context of a plasma-enhanced

reaction. Thus, Matsuo does not describe configuring an apparatus such as with two reaction chambers separated from one another such that nitrogen radicals will react with a substrate in a process conversion step.

For the above stated reasons, independent claim 1 is not anticipated by Matsuo. Claims 2-4 depend from claim 1 and therefore contain all the limitations of that claim. It is also noted, with respect to claim 4, that Matsuo does not describe the dimensions of a remote chamber configured that substantially all of the ions generated by the nitrogen plasma are changed from an ionic state to a charge neutral state within the remote chamber. Matsuo is not focused on the conversion of nitrogen into a plasma but the reaction of nitrogen with oxygen. Accordingly, claims 2-4 are not anticipated by Matsuo.

Independent claim 6 is also not anticipated by Matsuo, because Matsuo does not describe an apparatus including means for generating a plasma from a nitrogen gas in a first reaction chamber, and means for providing the plasma to a second reaction chamber having means for housing a substrate, in such a manner to be substantially free of ions such that the radicals react with a substrate in a process conversion step. As noted above with respect to claim 1, Matsuo is not concerned with generating a nitrogen plasma but with reacting the nitrogen with oxygen.

claim 6
in reply

Applicants respectfully request the Patent Office withdraw the rejection to claims 6 under 35 U.S.C. §102(b).

C. 35 U.S.C. §102(B): Rejection of Claims 17-20

The Patent Office rejects claims 17-20 under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 5,082,517 issued to Moslehi (Moslehi). Moslehi describes a system for controlling the plasma density in the context of deposition, etching, and cleaning by remotely locating a plasma source from the reaction chamber.

"Consequently, there is a need for a device that adjustably controls the plasma-generating electromagnetic power that a fabrication process gas receives to produce a process plasma consisting of activated charged and neutral species."

Column 2, lines 37-41 (emphasis added).

Independent claim 17 is not anticipated by Moslehi, because Moslehi does not describe a system controller configured to control the introduction of a gas into the first chamber, a memory of the controller, and a computer-readable program in the memory comprising instructions for controlling a gas source and an energy source converting a portion of a gas supplied by gas source in the plasma comprising ions and radicals and to deliver the plasma from a first chamber to a second chamber substantially free of ions to react with a substrate in the second chamber in a process conversion step. Moslehi is primarily concerned with deposition

and etching. Accordingly Moslehi teaches introducing activated charged and neutral species into a process chamber. Independent claim 17 relates to a system suitable for process conversion or growth. A conversion or growth process on a substrate is not deposition or etching. For example, the introduction of nitrogen into an oxide on a substrate according to the Application may convert a portion of the oxide to silicon nitride. This is in contrast to depositing a silicon nitride film on a substrate. Moslehi is concerned with the latter instance and thus does not describe instructions for controlling the gas source and energy source to deliver a plasma to a processing chamber substantially free of ions.

For the above stated reasons, independent claim 17 is not anticipated by Moslehi. Claims 18 and 19 depend from claim 17 and contain all the limitations of that claim. Claim 18 adds that the first chamber or plasma generation chamber is configured such that substantially all of the ions generated in a plasma are changed from an ionic state to a neutral state in the plasma generation chamber. Moslehi does not address such dimensions, because Moslehi teaches delivering both charged and neutral species to a process chamber. Claim 19 further describes the gas as nitrogen which is also not addressed by Moslehi in the context of the other limitations. For the reasons stated, Applicants respectfully

request that the Patent Office withdraw the rejection to claims 17-19 under 35 U.S.C. §102(b).

Independent claim 20 is not anticipated by Moslehi, because Moslehi does not describe a machine readable storage medium comprising instructions to perform a method of generating a plasma of radicals and ions to the first chamber and transferring the plasma radicals into a second chamber substantially free of ions. Again, Moslehi is directed at supplying a plasma consisting of charged and neutral species to a process chamber, consistent with either etching or deposition. Applicants respectfully request the Patent Office withdraw the rejection to claim 20 under 35 U.S.C. §102(b).

D. Objection to Claim 5

The Patent Office objects to claim 5 as failing to further limit claim 1. Applicants believe such objection is inappropriate, since a rapid thermal processing chamber describes one type of chamber and there are other reactors or chambers for which process conversion operations may take place. A tube furnace is a classic example of a different reaction chamber.

For the above stated reason, Applicants respectfully request the Patent Office withdraw the objection to claim 5.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Dated: 8/23/50

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8/23/00
Date